FORM PTO-1390 (Modified) (REV 11-98) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER	
112740-212	
U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR)	
09/868225	

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/EP99/09866	13 December 1999	15 December 1998

TITLE OF INVENTION

METHOD FOR DATA TRANSMISSION VIA A PACKET-ORIENTED COMMUNICATIONS NETWORK

APPLICANT(S) FOR DO/EO/US

Wolfgang Fraas et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☒ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☒ Certificate of Mailing by Express Mail
20. ☒ Other items or information:

Submission of Drawings - Figures 1-6 on sixsheets

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/868225	PCT/EP99/09866	112740-212

21. The following fees are submitted:.

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

		CALCULATIONS PTO USE ONLY
☐	Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO and International Search Report not prepared by the EPO or JPO	$1,000.00
☒	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but Internation Search Report prepared by the EPO or JPO	$860.00
☐	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO	$710.00
☐	International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4)	$690.00
☐	International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4)	$100.00

ENTER APPROPRIATE BASIC FEE AMOUNT = $860.00

Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)). $0.00

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	11 - 20 =	0	x $18.00	$0.00
Independent claims	1 - 3 =	0	x $80.00	$0.00
Multiple Dependent Claims **(check if applicable)**.			☐	$0.00

TOTAL OF ABOVE CALCULATIONS = $860.00

Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) **(check if applicable)**. ☐ $0.00

SUBTOTAL = $860.00

Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). + $0.00

TOTAL NATIONAL FEE = $860.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).** ☐ $0.00

TOTAL FEES ENCLOSED = $860.00

Amount to be: refunded $

charged $

☒ A check in the amount of **$860.00** to cover the above fees is enclosed.

☐ Please charge my Deposit Account No. in the amount of to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **02-1818** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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REGISTRATION NUMBER

June 15, 2001
DATE

BOX PCT

IN THE UNITED STATES ELECTED/DESIGNATED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY-CHAPTER II

PRELIMINARY AMENDMENT

APPLICANTS: Wolfgang Fraas et al. DOCKET NO: 112740-212
SERIAL NO: GROUP ART UNIT:
EXAMINER:
INTERNATIONAL APPLICATION NO: PCT/EP99/09866
INTERNATIONAL FILING DATE: 13 December 1999
INVENTION: METHOD FOR DATA TRANSMISSION VIA A PACKET-ORIENTED COMMUNICATIONS NETWORK

Assistant Commissioner for Patents,
Washington, D.C. 20231

Sir:

Please amend the above-identified International Application before entry into the National stage before the U.S. Patent and Trademark Office under 35 U.S.C. §371 as follows:

In the Specification:

Please replace the Specification of the present application, including the Abstract, with the following Substitute Specification:

SPECIFICATION

TITLE

METHOD FOR DATA TRANSMISSION VIA A PACKET-ORIENTED COMMUNICATIONS NETWORK

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates, generally, to a method for data transmission between two communications devices via a packet-oriented communications network

and, more specifically, to a transmission system for transmitting time-slot-oriented data between an exchange termination device ET and a line termination LT. According to the terminology of the ITU-T G.960 (3/93) standard, "access digital section for ISDN basic rate access" (International Telecommunication Union), in particular pages 2 and 3, the invention correspondingly relates to data transmission on the "V reference point".

Description of the Prior Art

A method is known, for example, from US patent specification US-A-5793766 for two-way data transmission between communications devices supporting a time-slot-oriented data transmission protocol, having channel-specific information segments, via a packet-oriented communications network. Here, the data packets used to transmit data via the packet-oriented communications network are subdivided into a first sub-packet and into a second sub-packet, data of different channel-specific information segments in each case being transmitted in a first data packet.

A transmission system for transmitting time-slot-oriented data between an exchange termination device and a line termination normally forms part of a communications system which has a switching device and subscriber connection devices. The subscriber connection devices have subscriber interfaces for connecting communications terminal devices to the communications system. According to the ITU-T G.960 standard, the subscriber connection devices are connected via a line termination and an exchange termination device to the switching device of the communications system. A communications system of this type serves to set up or clear down narrowband communications connections between communications terminal devices connected to the subscriber connection devices and to enable narrowband communication (for example, voice or data communication) between the communications terminal devices.

In modern communications systems, data transmission normally takes place between the exchange termination device and the line termination on the basis of the time-slot-oriented data format IOM-2 (ISDN Oriented Modular Interface), which is formed from a periodic sequence of channel-specific information segments; referred

to below as the time division multiplex channel. One time division multiplex channel is normally allocated, in each case, to each subscriber interface of a subscriber connection device.

In modern communications technology, there is a need for broadband transmission of information; for example, still and moving pictures in videotelephony applications or large data volumes on the Internet. This increases the importance of transmission technology for high and variable data transmission rates (greater than 100 Mbit/s), which take account both of data transmission requirements (high speed with variable transmission bit rate) and voice data transmission requirements (maintenance of temporal correlations in the case of data transmission via a network), in order to be able to integrate the separate networks currently existing for the different purposes into one network. A known data transmission method for high data speeds is referred to as Asynchronous Transfer Mode (ATM). Data transmission on the basis of the Asynchronous Transfer Mode currently enables a variable transmission bit rate of up to 622 Mbit/s.

In the cell-based data transmission method known as Asynchronous Transfer Mode (ATM), fixed-length data packets, referred to as ATM cells, are used for data transport. An ATM cell includes a five-byte cell header containing switching data relevant to the transport of an ATM cell, and a 48-byte user data field, referred to as the 'payload'.

Data transmission via an ATM-based communications network generally takes place in "virtual paths" or in virtual channels contained in the virtual paths. To do this, connection tables with switching information including a "virtual channel identifier" and a "virtual path identifier" are created when a connection is set up, before the start of the actual user data transmission, by exchanging signaling information in the respective ATM network nodes of the ATM-based communications network. In the connection tables, a "VCI value" is allocated to the virtual channel identifier and a "VPI value" is allocated to the virtual path identifier. The switching information recorded in the connection table of an ATM network node determines how the virtual paths or virtual channels contained in the virtual paths of the incoming and outgoing

connections on the ATM network node are allocated to one another by the signaling; i.e., which input is linked by the switching system to which output of the ATM network node. The cell header of ATM cells transmitted via these virtual connections (virtual paths and virtual channels) essentially contains switching data including a VPI value and a VCI value. The ATM cell header data is processed at the input of an ATM network node; i.e., the switching data disposed therein is collected and evaluated. The ATM cells are then switched through the ATM network node using the switching information stored in the connection table to an output of the ATM network node representing a specific destination.

In the German patent application with the official reference 198 45 038.9, a transmission system between an exchange termination device and a line termination has already been proposed in which the transmission is implemented via an ATM-based communications network. Here, subscriber interfaces are made available in order to connect communications terminal devices via ATM transfer units, which are frequently referred to in the literature as the "ATM hub", which are connected to the ATM-based communications network. The exchange termination device of the communications system and the line termination implemented by the ATM transfer unit in each case have an ATM connection unit, via which, on the one hand, a connection to the ATM-based communications network is implemented and, on the other hand, a two-way conversion is carried out between the IOM-2 data format, normally provided for data transmission between the exchange termination device and the line termination, and the ATM data format.

The two-way conversion between the time-slot-oriented IOM-2 data format and the cell-based ATM data format takes place according to two different conversion methods. According to the first conversion method, on the basis of the specification CES 2.0 of the ATM Forum, the time-slot-oriented data is packeted byte-by-byte in ATM cells according to the first ATM adaptation layer AAL1. The ATM adaptation layer AAL (ATM Adaptation Layer) serves to adapt the ATM data format (corresponding to Layer 2 of the OSI reference model) to the network layer (Layer 3) of the OSI reference model (Open System Interconnection). According to the second

conversion method, the time-slot-oriented data is packeted byte-by-byte into ATM cells substructured according to the second ATM adaptation layer AAL2.

An object of the present invention, therefore, is to offer an alternative method ~~via~~ which two-way data transmission can take place between the communications terminal devices and the switching system.

SUMMARY OF THE INVENTION

For a better understanding of the present invention with respect to the mode of operation of the transmission of time-slot-oriented data between an exchange termination device and a line termination, it is necessary to begin by re-examining known principles in more detail.

Transmission of the time-slot-oriented data between the exchange termination device and the line termination normally takes place, for example, on the basis of the IOM-2 data format known from the product document entitled "ICs for Communications – IOM®-2 Interface Reference Guide" from Siemens, Munich, 3/91, Order No. B115-H6397-X-X-7600, in particular pages 6 to 12.

A more rapid understanding of the relationships is provided by Fig. 1, which shows a schematic representation of the IOM-2 data format according to which time division multiplex frames IOM-R with a length of 125 µs are periodically transmitted. A time division multiplex frame IOM-R of this type is divided up into time division multiplex channels or subframes CH0,.., CH7; also frequently referred to in literature simply as "channels". The subframes CH0,.., CH7 are, in turn, subdivided in each case into two 8-bit user data channels B1, B2, into one 8-bit monitor channel M, into one 2-bit control information channel DI, into one 4-bit status channel C/I (Command/Indicate) and into in each case two 1-bit monitor status channels MR, MX. The control information channel DI, the status channel C/I and the two monitor status channels MR, MX are normally referred to jointly as the control channel D.

User data is transmitted via the user data channels B1, B2 between devices connected to an IOM-2 bus at a transmission bit rate in each case of 64 kbit/s. Control information allocated to the user data is transmitted via the control information channel D at a transmission bit rate of 16 kbit/s. The monitor channel serves, inter alia, to configure

devices connected to an IOM-2 bus on the basis of an "IOM-2 bus master". The monitor status channels MR (Monitor Read) and MX (Monitor Transmit) serve to determine whether data from a device connected to the IOM-2 bus are read by the IOM-2 bus (MR = 1, MX = 0) or are output onto the IOM-2 bus (MR = 0, MX = 1). Information relating to real-time requirements which exist during data transmission between two devices connected to an IOM-2 bus are exchanged via the status channel C/I.

In the case of data transmission via an ATM-based communications network via ATM cells according to the first ATM adaptation layer AAL1, only one constant transmission bit rate can be implemented between the switching system and an ATM transfer unit since, irrespective of whether data is or is not actually transmitted, all channel information, of the two user data channels B1, B2 , the monitor channel M and the control channel D, of the IOM-2 data format must be transmitted. On the other hand, in the case of data transmission via the ATM-based communications network via ATM cells according to the second ATM adaptation layer AAL2, a variable transmission bit rate can be implemented between the switching system and an ATM transfer unit, since the possibility exists for transmitting only individual channel information which is currently transmitting data.

An essential advantage of the method according to the present invention is that the method can be implemented in a simple manner in already existing systems without modifications being necessary at the interface between the switching system and the ATM transfer unit, referred to as the V reference point according to the terminology of the ITU-T G.960 standard.

One advantage of designs of the present invention defined herein is, inter alia, that through sub-structuring into subpackets of the user data area of a data packet used for data transmission, to which channel-specific information of the time-slot-oriented data format can in each case be allocated, a variable transmission bit rate can be implemented in a simple manner between the switching system and the transfer units through non-transmission of individual subpackets containing no user data.

A further advantage of designs of the present invention defined in the

subclaims is that, for two-way conversion between the time-slot-oriented IOM-2 data format and the packet-oriented ATM data format according to the fifth ATM adaptation layer AAL5, already existing AAL5 components can be used, so that no new developments are required.

A further advantage of designs of the present invention is that, through data transmission between a communications terminal device and the switching system via an existing dedicated connection between the switching system (PBX) and the ATM transfer unit via which the communications terminal device is connected to the ATM-based communications network, or, alternatively, via a connection individually set up for this data transmission, the "signaling load" or the administrative outlay can be adapted in a simple manner to current circumstances in or for the communications network.

Additional features and advantages of the present invention are described in, and will be apparent from, the following Detailed Description of the Preferred Embodiments and the Drawings.

DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a schematic representation of an IOM-2 data format;

Fig. 2 shows a structural diagram schematically representing the essential functional units involved in the method according to the present invention;

Fig. 3 shows a structural diagram schematically representing an ATM cell subdivided into subpackets;

Fig. 4 shows a structural diagram schematically representing the conversion of the time-slot-oriented IOM-2 data format into the ATM data format according to the fifth ATM adaptation layer AAL5;

Fig. 5 shows a flowchart illustrating the method steps which take place during data transmission according to a first connection type of the communications terminal devices; and

Fig. 6 shows a flowchart illustrating the method steps which take place during data transmission according to a second connection type of the communications terminal devices.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 2 shows a schematic representation of a switching system PBX (Private Branch Exchange) with an exchange termination unit ET (Exchange Termination) disposed therein. The exchange termination unit ET is connected via a connection unit AE to an ATM-based communications network ATM-KN. Furthermore, ATM transfer units ATM-HUB, which have subscriber interfaces to connect communications terminal devices to the ATM-based communications network ATM-KN, are connected to the ATM-based communications network ATM-KN. Communications terminal devices KE1,..., KEn are shown as examples.

Via an ATM transfer unit, ISDN communications terminal devices (Integrated Services Digital Network) are normally connected via S_0 interfaces, or digital communications terminal devices are normally connected via interfaces derived therefrom, such as U_{p0} interfaces, to the ATM-based communications network ATM-KN. Generally, an S_0 interface or a U_{p0} interface includes, on the one hand, 2 user data channels which are designed as ISDN-oriented B-channels with a transmission bit rate in each case of 64 kbit/s and, on the other hand, a signaling channel which is designed as an ISDN-oriented D-channel with a transmission bit rate of 16 kbit/s. Furthermore, the possibility generally exists for connecting analog communications terminal devices via a/b interfaces to the ATM-based communications network ATM-KN.

The communications terminal devices KE1,...,KEn are connected to the ATM transfer unit ATM-HUB; i.e., the subscriber interfaces are provided by the ATM transfer unit ATM-HUB according to the terminology of the ITU-T G.960 standard via network terminations NT (Network Termination). According to the ITU-T G.960 standard (International Telecommunication Union), the network terminations NT of an ATM transfer unit ATM-HUB are connected via a line termination LT disposed in the ATM transfer unit ATM-HUB to the exchange termination device ET of the switching system PBX. For data transmission via the ATM-based communications network ATM-KN, the line termination LT, corresponding to the exchange termination device ET of the switching system PBX, is connected via a connection unit AE to the ATM-based communications network ATM-KN.

A two-way conversion between the time-slot-oriented IOM-2 data format, normally provided for data transmission between the exchange termination device and the line termination, and the packet-oriented ATM data format according to the fifth ATM adaptation layer AAL5 is carried out by the connection units AE.

Fig. 3 shows a schematic representation of an ATM cell subdivided into subpackets according to the fifth ATM adaptation layer AAL5. The ATM adaptation layer AAL (ATM Adaptation Layer) serves to adapt the ATM cell format (Layer 2 of the OSI reference model) to the network layer (Layer 3) of the OSI reference model (Open System Interconnection).

An ATM cell ATMZ generally includes a five-byte cell header H, frequently referred to as the "header" containing switching data relevant to the transport of an ATM cell ATMZ and a 48-byte user data field N, frequently referred to as the "payload". In the case of an ATM cell ATMZ subdivided according to the fifth ATM adaptation layer AAL5, the user data area N is subdivided into at least one first subpacket TP1 and into a second subpacket TP2. First subpackets TP1 are shown in Figure 4 as examples.

A first subpacket TP1 is, in turn, subdivided into a 1-byte packet cell header SH and into a user data field of a defined length. The packet cell header SH includes a 3-bit segment identifier CI, also referred to as the "channel identifier", and a 5-bit length identifier LI, also referred to as the "length identifier". Via the 5-bit length identifier LI, user data fields of the first subpackets TP1 with a length n of $2^5 = 32$ bytes can essentially be defined. However, the first subpackets TP1 advantageously have a length of 10 bytes. Correspondence with the ATM Forum standard af-vtoa-0083.000, "Voice and Telephony over ATM to the Desktop Specification", 5/1997, is thereby achieved, in which a maximum user data field length of 40 bytes is provided for data transmission according to the fifth ATM adaptation layer AAL5.

The second subpacket TP2 is preferably used for the transport of dummy data L, but can also be used for what is frequently referred to as a cyclic redundancy check CRC. The length of the second subpacket TP2 is selected in such a way that the total length of the first data packets TP1 transmitted in an ATM cell ATMZ and the second

subpacket TP2 corresponds to the length of the user data area N of the ATM cell ATMZ; i.e., 48 bytes. However, the length of a second subpacket TP2 for adaptation to the af-vtoa-0083.000 standard of the ATM Forum is at least 8 bytes.

Fig. 4 shows, in a schematic representation, the conversion of the time-slot-oriented IOM-2 data format into the packet-oriented ATM data format according to the fifth ATM adaptation layer AAL5. In a conversion from the time-slot-oriented IOM-2 data format to the packet-oriented ATM data format, a unique VPI/VCI address is allocated to each subframe CHx for transmission via the ATM-based communications network ATM-KN; i.e., data allocated to different subframes CHx are transmitted in separate ATM cells ATMZ with a unique VPI/VCI address stored in the cell header H of the ATM cell ATMZ, shown as an example for the subframe CH0.

In the fifth ATM adaptation layer AAL5, as already described above, the user data area N of an ATM cell ATMZ can be subdivided into first and second subpackets TP1, TP2. Via the subdivision of an ATM cell ATMZ into first and second subpackets TP1, TP2, a number of channels can be defined within an ATM connection via the 3-bit segment identifier CI and are all provided with the same ATM address, which includes a VPI value and a VCI value. Here, for example, a CI address 011 is selected for the first user data channel B1, a CI address 100 for the second user data channel B2, a CI address 010 for the monitor channel M and a CI address 001 for the control channel D. In data transmission between the switching system PBX and an ATM transfer unit ATM-HUB, in particular an exchange termination device ET and a line termination LT, the possibility thus exists for data to be transmitted only of those channels (the first user data channel B1, the second user data channel B2, the monitor channel M and the control channel D) via which data is actually currently being transmitted.

In the present embodiment, one first subpacket TP1 of identical length is in each case defined successively for the first user data channel B1, the second user data channel B2, the monitor channel M and the control channel D of a subframe CHx, shown for the subframe CH0 as an example, and is transmitted in the user data area of the ATM cell ATMZ. Four first subpackets TP1 with a respective length of 10 bytes

are shown as examples in Fig. 4. Following the first subpacket TP1 allocated to the control channel C, a second subpacket TP2 is transmitted. The length of the second subpacket TP2 is selected in this case in such a way that the total length of the first data packets TP1 transmitted in an ATM cell ATMZ and the second subpacket TP2 corresponds to the length of the user data area N of the ATM cell ATMZ; i.e., 48 bytes. In the present embodiment, the second subpacket TP2 thus has a length of 8 bytes.

The communications terminal devices KE1, ..., KEn can be connected to the switching system PBX via the ATM-based communications network ATM-KN according to two different connection types, which are described in more detail below.

According to a first connection type, a "dedicated connection" based on the fifth ATM adaptation layer AAL5 is set up in each case between the switching system PBX and the ATM transfer units ATM-HUB of the ATM-based communications network ATM-KN, a definable transmission bit rate being guaranteed for a predefinable period for the dedicated connection. In the ATM-based communications network ATM-KN, this corresponds to the setting up in each case of a virtual connection between the switching system PBX and the ATM transfer units ATM-HUB of the ATM-based communications network ATM-KN which may, if necessary, also contain a number of virtual transmission channels.

The dedicated connection is set up here by administrative measures, wherein a transmission channel (frequently referred to as a "Virtual Channel Connection" VCC) can be individually allocated to each communications terminal device KE1,..., KEn connected via the ATM-based communications network ATM-KN to the switching system PBX.

Fig. 5 shows a flowchart to illustrate the method steps which take place during data transmission between a communications terminal device KE1,..., KEn and the switching system PBX while a dedicated connection exists between the switching system PBX and the ATM transfer unit ATM-HUB which provides the connection unit AE for the relevant communications terminal device KE1,..., KEn. Starting with the communications terminal device KE1,..., KEn in idle mode, in the event of a request

for a connection to the communications terminal device KE1,..., KEn, what is frequently referred to in the literature as the "Home PBX" of the communications terminal device KE1,..., KEn, i.e. the switching system PBX to which the communications terminal device KE1,..., KEn is registered, is identified by the corresponding ATM transfer unit ATM-HUB. The transmission channel VCC allocated to the communications terminal device KE1,..., KEn for data transmission via the ATM-based communications network ATM-KN is then determined, thereby providing a virtual connection via the ATM-based communications network ATM-KN during the already existing dedicated connection. Through the use of a connection based on the fifth ATM adaptation layer AAL5, the possibility exists for transmitting via the connection only data of the channels of the IOM-2 data format via which data are currently to be transmitted.

In a subsequent step, the signaling information required in order to set up a connection between the communications terminal device KE1,..., KEn and the switching system PBX is transmitted via the control channel D of the IOM-2 data format; i.e., a logical connection is set up between the communications terminal device KE1,..., KEn and the switching system PBX. The two-way user data transmission then takes place between the communications terminal device KE1,..., KEn and the switching system PBX via one or, alternatively, both user data channels B1, B2 of the IOM-2 data format. If the logical connection is subsequently to be cleared down between the communications terminal device KE1,..., KEn and the switching system PBX, for example as a result of a handset going on-hook on the communications terminal device KE1,..., Ken, it is carried out via corresponding signaling between the communications terminal device KE1,..., KEn and the switching system PBX via the control channel D. At the end of the connection, the communications terminal device KE1,..., KEn reverts to idle mode; i.e., no transmission resources are withdrawn from the ATM-based communications network ATM-KN by the transmission channel VCC.

However, dedicated connections of this type can be set up in a communications network in a limited number only, depending on the size and available transmission

bandwidth of this communications network. Furthermore, with changing communications relationships between the communications units involved, all communications and data connections concerned (in an ATM-based communications network, all virtual transmission channels contained in a virtual path) must be taken into account. As a result, the administrative outlay for dedicated connections of this type increases very rapidly with the size of the communications network.

In order to reduce the administrative outlay, the communications terminal devices KE1,..., KEn can be connected alternatively to the switching system PBX according to a second connection type via "signaled connections"; i.e., a connection between the switching system PBX and the ATM transfer unit ATM-HUB which provides the connection unit AE for the relevant communications terminal device KE1,..., Ken via the ATM-based communications network ATM-KN is set up only when data transmission is actually to take place. The consequence of this, however, in contrast to the dedicated connections described, is that the "signaling load" in the ATM-based communications network ATM-KN increases.

Fig. 6 shows a flowchart illustrating the method steps which take place during data transmission between a communications terminal device KE1,..., KEn and the switching system PBX during a signaled connection. Starting with the communications terminal device KE1,..., KEn in idle mode, in the event of a request for a connection to the communications terminal device KE1,..., KEn, the "Home PBX" of the communications terminal device KE1,..., KEn is identified by the corresponding ATM transfer unit ATM-HUB. A connection based on the fifth ATM adaptation layer AAL5 is then set up by the ATM transfer unit ATM-HUB to the channels required for the IOM-2 data format (the first user data channel B1, the second user data channel B2, the monitor channel M and the control channel D) between the ATM transfer unit ATM-HUB and the switching system PBX via the ATM-based communications network ATM-KN. Once it has been set up, this connection is made available to the communications terminal device KE1,..., KEn for data transmission between the communications terminal device KE1,..., KEn and the switching system PBX. Through the use of a connection based on the fifth ATM adaptation layer AAL5, the

possibility exists for transmitting via the connection only data of the channels of the IOM-2 data format via which data is currently to be transmitted.

In a subsequent step, the signaling information required in order to set up a connection between the communications terminal device KE1,..., KEn and the switching system PBX is transmitted via the control channel D; i.e., a logical connection is set up between the communications terminal device KE1,..., KEn and the switching system PBX. The two-way user data transmission then takes place between the communications terminal device KE1,..., KEn and the switching system PBX via one or, alternatively, both user data channels B1, B2. If the logical connection is subsequently to be cleared down between the communications terminal device KE1,..., KEn and the switching system PBX, for example as a result of a handset going on-hook on the communications terminal device KE1,..., Ken, it is carried out via corresponding signaling between the communications terminal device KE1,..., KEn and the switching system PBX via the control channel D. Finally, the ATM transfer unit ATM-HUB again clears down the connection between the switching system PBX and the ATM transfer unit ATM-HUB via the ATM-based communications network ATM-KN. The communications terminal device KE1,..., KEn then reverts to idle mode.

Although the present invention has been described with reference to specific embodiments, those of skill in the art will recognize that changes may be made thereto without departing from the spirit and scope of the invention as set forth in the hereafter appended claims.

ABSTRACT OF THE DISCLOSURE

A method for data transmission via a packet-oriented communications network, wherein, communications terminal devices are connected to the packet-oriented communications network via at least one transfer unit and a switching system. To transmit data between the switching system and the communications terminal devices, a time-slot-oriented data format is provided, which is formed from a periodic sequence of channel-specific information segments. For the transmission of data via the communications network, a user data area of a data packet used to transmit data via the

communications network is subdivided into at least one first subpacket and into a second subpacket, data of a channel-specific information segment being transmitted in each case in the first subpackets.

In the claims:

On page 17, cancel line 1, and substitute the following left-hand justified heading therefor:

We Claims as Our Invention:

Please cancel claims 1-11, without prejudice, and substitute the following claims therefor:

12. A method for data transmission between two communications devices via a packet-oriented communications network, the method comprising the steps of:

providing a time-slot-oriented data format, formed from a periodic sequence of channel-specific information segments, for the data transmission between the two communications devices;

providing a data packet for the data transmission between the two communications devices wherein the data packet includes a user data area;

subdividing the user data area into at least one first subpacket of a first length and into a second subpacket of a second length; and

transmitting data of the same channel-specific information segment in a respective one of the at least one first subpacket.

13. A method for data transmission between two communications devices via a packet-oriented communications network as claimed in claim 12, the method further comprising the step of:

effecting the data transmission between communications terminal devices and a switching system, the communications terminal devices being connected via at least one transfer unit to the packet-oriented communications network.

14. A method for data transmission between two communications devices via a packet-oriented communications network as claimed in claim 12, the method

further comprising the step of:

allocating each of the at least one first subpacket to the respective channel-specific information segment, the transmission of each of the at least one first subpacket being suppressible.

15. A method for data transmission between two communications devices via a packet-oriented communications network as claimed in claim 12, the method further comprising the steps of:

transmitting dummy data in the second subpacket; and

selecting the length of the second subpacket such that a total length of the transmitted at least one first subpacket and the second subpacket corresponds to a length of the user data area of the data packet.

16. A method for data transmission between two communications devices via a packet-oriented communications network as claimed in claim 12, wherein the second data packet is at least 8 bytes long.

17. A method for data transmission between two communications devices via a packet-oriented communications network as claimed in claim 12, wherein the at least one first subpacket includes one cell header with a segment identifier and a length identifier, and wherein the at least one first subpacket is allocated by the segment identifier to the respective channel-specific information segment, and the number of data transmitted in the respective at least one first subpacket is defined by the length identifier.

18. A method for data transmission between two communications devices via a packet-oriented communications network as claimed in claim 12, wherein the time-slot-oriented data format is a standardized IOM-2 data format.

19. A method for data transmission between two communications devices

via a packet-oriented communications network as claimed in claim 12, wherein data is transmitted via the packet-oriented communications network based on an Asynchronous Transfer Mode data format.

20. A method for data transmission between two communications devices via a packet-oriented communications network as claimed in claim 19, wherein two-way conversion between the time-slot-oriented data format and the Asynchronous Transfer Mode data format is effected via a fifth Asynchronous Transfer Mode adaptation layer AAL5 agreement.

21. A method for data transmission between two communications devices via a packet-oriented communications network as claimed in claim 19, wherein data to be transmitted between a communications terminal device and a switching system is transmitted via an existing dedicated connection between the switching system and the Asynchronous Transfer Mode transfer unit, via which the communications terminal device is connected to the Asynchronous Transfer Mode-based communication network.

22. A method for data transmission between two communications devices via a packet-oriented communications network as claimed in claim 19, wherein data to be transmitted between a communications terminal device and a switching system is transmitted via a connection individually set up for the data transmission between the switching system and the Asynchronous Transfer Mode transfer unit, via which the communications terminal device is connected to the Asynchronous Transfer Mode-based communications network.

REMARKS

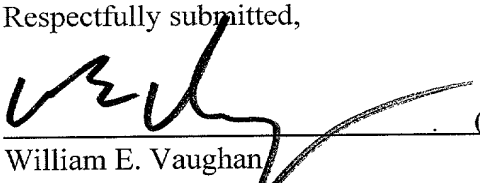
The present amendment makes editorial changes and corrects typographical errors in the specification, which includes the Abstract, in order to conform the specification to the requirements of United States Patent Practice. No new matter is added thereby. Attached hereto is a marked-up version of the changes made to the

specification by the present amendment. The attached page is captioned "**Version With Markings To Show Changes Made**".

In addition, the present amendment cancels original claims 1-11 in favor of new claims 12-22. Claims 12-22 have been presented solely because the revisions by red-lining and underlining which would have been necessary in claims 1-11 in order to present those claims in accordance with preferred United States Patent Practice would have been too extensive, and thus would have been too burdensome. The present amendment is intended for clarification purposes only and not for substantial reasons related to patentability pursuant to 35 USC §§103, 102, 103 or 112. Indeed, the cancellation of claims 1-11 does not constitute an intent on the part of the Applicants to surrender any of the subject matter of claims 1-11.

Early consideration on the merits is respectfully requested.

Respectfully submitted,



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VERSIONS WITH MARKINGS TO SHOW CHANGES MADE

In The Specification:

The Specification of the present application, including the Abstract, has been amended as follows:

SPECIFICATION

TITLE

~~**Method for data transmission via a packet-oriented communications network**~~

METHOD FOR DATA TRANSMISSION VIA A PACKET-ORIENTED COMMUNICATIONS NETWORK

BACKGROUND OF THE INVENTION

~~Description~~

Field of the Invention

The present invention relates, generally, to a method for data transmission between two communications devices via a packet-oriented communications network ~~according to the preamble to claim 1. The invention relates in particular~~ and, more specifically, to a transmission system for transmitting time-slot-oriented data between an exchange termination device ET and a line termination LT. According to the terminology of the ITU-T G.960 (3/93) standard, "access digital section for ISDN basic rate access" (International Telecommunication Union), in particular pages 2 and 3, the invention correspondingly relates to data transmission on the "V reference point".

Description of the Prior Art

A method is known, for example, from US patent specification US-A-5793766 for two-way data transmission between communications devices supporting a time-slot-oriented data transmission protocol, ~~comprising~~ having channel-specific information segments, via a packet-oriented communications network. Here, the data packets used to transmit data via the packet-oriented communications network are subdivided into a first sub-packet and into a second sub-packet, data of different channel-specific information segments in each case being transmitted in a first data packet.

A transmission system for transmitting time-slot-oriented data between an exchange termination device and a line termination normally forms part of a communications system which has a switching device and subscriber connection devices. The subscriber connection devices have subscriber interfaces for connecting communications terminal devices to the communications system. According to the ITU-T G.960 standard, the subscriber connection devices are connected via a line termination and an exchange termination device to the switching device of the communications system. A communications system of this type serves to set up or clear down narrowband communications connections between communications terminal devices connected to the subscriber connection devices and to enable narrowband communication (for example, voice or data communication) between the communications terminal devices.

In modern communications systems, data transmission normally takes place between the exchange termination device and the line termination on the basis of the time-slot-oriented data format IOM-2 (ISDN Oriented Modular Interface), which is formed from a periodic sequence of channel-specific information segments; referred to below as the time division multiplex channel. One time division multiplex channel is normally allocated, in each case, to each subscriber interface of a subscriber connection device.

In modern communications technology, there is a need for broadband transmission of information; for example, still and moving pictures in videotelephony applications or large data volumes on the Internet. This increases the importance of transmission technology for high and variable data transmission rates (greater than 100 Mbit/s), which take account both of data transmission requirements (high speed with variable transmission bit rate) and voice data transmission requirements (maintenance of temporal correlations in the case of data transmission via a network), in order to be able to integrate the separate networks currently existing for the different purposes into one network. A known data transmission method for high data speeds is referred to as Asynchronous Transfer Mode (ATM). Data transmission on the basis of the Asynchronous Transfer Mode currently enables a variable transmission bit rate of up

to 622 Mbit/s.

In the cell-based data transmission method known as Asynchronous Transfer Mode (ATM), fixed-length data packets, referred to as ATM cells, are used for data transport. An ATM cell ~~comprises~~ includes a five-byte cell header containing switching data relevant to the transport of an ATM cell, and a 48-byte user data field, referred to as the 'payload'.

Data transmission via an ATM-based communications network generally takes place in "virtual paths" or in virtual channels contained in the virtual paths. To do this, connection tables with switching information ~~comprising~~ including a "virtual channel identifier" and a "virtual path identifier" are created when a connection is set up, before the start of the actual user data transmission, by exchanging signaling information in the respective ATM network nodes of the ATM-based communications network. In the connection tables, a "VCI value" is allocated to the virtual channel identifier and a "VPI value" is allocated to the virtual path identifier. The switching information recorded in the connection table of an ATM network node determines how the virtual paths or virtual channels contained in the virtual paths of the incoming and outgoing connections on the ATM network node are allocated to one another by the signaling~~;~~, i.e., which input is linked by the switching system to which output of the ATM network node. The cell header of ATM cells transmitted via these virtual connections (virtual paths and virtual channels) essentially contains switching data ~~comprising~~ including a VPI value and a VCI value. The ATM cell header data ~~are~~ is processed at the input of an ATM network node~~;~~, i.e., the switching data disposed therein ~~are~~ is collected and evaluated. The ATM cells are then switched through the ATM network node using the switching information stored in the connection table to an output of the ATM network node representing a specific destination.

In the German patent application with the official reference 198 45 038.9, a transmission system between an exchange termination device and a line termination has already been proposed in which the transmission is implemented via an ATM-based communications network. Here, subscriber interfaces are made available in order to connect communications terminal devices ~~by means of~~ via ATM transfer units,

which are frequently referred to in the literature as the "ATM hub", which are connected to the ATM-based communications network. The exchange termination device of the communications system and the line termination implemented by the ATM transfer unit in each case have an ATM connection unit, via which, on the one hand, a connection to the ATM-based communications network is implemented and, on the other hand, a two-way conversion is carried out between the IOM-2 data format, normally provided for data transmission between the exchange termination device and the line termination, and the ATM data format.

The two-way conversion between the time-slot-oriented IOM-2 data format and the cell-based ATM data format takes place according to two different conversion methods. According to the first conversion method, on the basis of the specification CES 2.0 of the ATM Forum, the time-slot-oriented data ~~are~~ is packeted byte-by-byte in ATM cells according to the first ATM adaptation layer AAL1. The ATM adaptation layer AAL (ATM Adaptation Layer) serves to adapt the ATM data format (corresponding to Layer 2 of the OSI reference model) to the network layer (Layer 3) of the OSI reference model (Open System Interconnection). According to the second conversion method, the time-slot-oriented data ~~are~~ is packeted byte-by-byte into ATM cells substructured according to the second ATM adaptation layer AAL2.

~~The~~ An object of the present invention, therefore, is to ~~indicate~~ offer an alternative method~~, by means of~~ via which two-way data transmission can take place between the communications terminal devices and the switching system.

~~The object is achieved on the basis of the features of the preamble to claim 1 by means of the latter's characterizing features.~~

SUMMARY OF THE INVENTION

For a better understanding of the present invention with respect to the mode of operation of the transmission of time-slot-oriented data between an exchange termination device and a line termination, it ~~appears~~ is necessary to begin by re-examining known principles in more detail.

Transmission of the time-slot-oriented data between the exchange termination device and the line termination normally takes place, for example, on the basis of the

IOM-2 data format known from the product document entitled "ICs for Communications – IOM®-2 Interface Reference Guide" from Siemens, Munich, 3/91, Order No. B115-H6397-X-X-7600, in particular pages 6 to 12.

A more rapid understanding of the relationships is provided by Fig. 1, which shows a schematic representation of the IOM-2 data format according to which time division multiplex frames IOM-R with a length of 125 µs are periodically transmitted. A time division multiplex frame IOM-R of this type is divided up into time division multiplex channels or subframes CH0,.., CH7; also frequently referred to in ~~the~~ literature simply as "channels". The subframes CH0,.., CH7 are, in turn, subdivided in each case into two 8-bit user data channels B1, B2, into one 8-bit monitor channel M, into one 2-bit control information channel DI, into one 4-bit status channel C/I (Command/Indicate) and into in each case two 1-bit monitor status channels MR, MX. The control information channel DI, the status channel C/I and the two monitor status channels MR, MX are normally referred to jointly as the control channel D.

User data ~~are~~ is transmitted via the user data channels B1, B2 between devices connected to an IOM-2 bus at a transmission bit rate in each case of 64 kbit/s. Control information allocated to the user data is transmitted via the control information channel D at a transmission bit rate of 16 kbit/s. The monitor channel serves, inter alia, to configure devices connected to an IOM-2 bus on the basis of an "IOM-2 bus master". The monitor status channels MR (Monitor Read) and MX (Monitor Transmit) serve to determine whether data from a device connected to the IOM-2 bus are read by the IOM-2 bus (MR = 1, MX = 0) or are output onto the IOM-2 bus (MR = 0, MX = 1). Information relating to real-time requirements which exist during data transmission between two devices connected to an IOM-2 bus are exchanged via the status channel C/I.

In the case of data transmission via an ATM-based communications network ~~by means of~~ via ATM cells according to the first ATM adaptation layer AAL1, only one constant transmission bit rate can be implemented between the switching system and an ATM transfer unit since, irrespective of whether data ~~are~~ is or ~~are~~ is not actually transmitted, all channel information - of the two user data channels B1, B2 , the

monitor channel M and the control channel D_2 of the IOM-2 data format must be transmitted. On the other hand, in the case of data transmission via the ATM-based communications network ~~by means of~~ via ATM cells according to the second ATM adaptation layer AAL2, a variable transmission bit rate can be implemented between the switching system and an ATM transfer unit, since the possibility exists for transmitting only individual channel information which is currently transmitting data.

An essential advantage of the method according to the present invention is that the method can be implemented in a simple manner in already existing systems without modifications being necessary at the interface between the switching system and the ATM transfer unit, referred to as the V reference point according to the terminology of the ITU-T G.960 standard.

~~Advantageous further developments of the invention are indicated in the subclaims.~~

One advantage of designs of the present invention defined ~~in~~ herein ~~the subclaims~~ is, inter alia, that, through sub-structuring into subpackets of the user data area of a data packet used for data transmission, to which channel-specific information of the time-slot-oriented data format can in each case be allocated, a variable transmission bit rate can be implemented in a simple manner between the switching system and the transfer units through non-transmission of individual subpackets containing no user data.

A further advantage of designs of the present invention defined in the subclaims is that, for two-way conversion between the time-slot-oriented IOM-2 data format and the packet-oriented ATM data format according to the fifth ATM adaptation layer AAL5, already existing AAL5 components can be used, so that no new developments are required.

A further advantage of designs of the present invention ~~defined in the subclaims~~ is that, ~~by means of~~ through data transmission between a communications terminal device and the switching system via an existing dedicated connection between the switching system (PBX) and the ATM transfer unit via which the communications terminal device is connected to the ATM-based communications network, or,

alternatively, via a connection individually set up for this data transmission, the ~~"~~signaling load~~"~~ or the administrative outlay can be adapted in a simple manner to current circumstances in or for the communications network.

Additional features and advantages of the present invention are described in, and will be apparent from, the following Detailed Description of the Preferred Embodiments and the Drawings.

~~An embodiment of the invention is explained in more detail below with reference to the drawing, in which:~~

DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a schematic representation of an IOM-2 data format;

Fig. 2 shows a structural diagram schematically representing the essential functional units involved in the method according to the present invention;

Fig. 3 shows a structural diagram schematically representing an ATM cell subdivided into subpackets;

Fig. 4 shows a structural diagram schematically representing the conversion of the time-slot-oriented IOM-2 data format into the ATM data format according to the fifth ATM adaptation layer AAL5;

Fig. 5 shows a flowchart illustrating the ~~essential~~ method steps which take place during data transmission according to a first connection type of the communications terminal devices; and

Fig. 6 shows a flowchart illustrating the ~~essential~~ method steps which take place during data transmission according to a second connection type of the communications terminal devices.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 2 shows a schematic representation of a switching system PBX (Private Branch Exchange) with an exchange termination unit ET (Exchange Termination) disposed therein. The exchange termination unit ET is connected via a connection unit AE to an ATM-based communications network ATM-KN. Furthermore, ATM transfer units ATM-HUB, which have subscriber interfaces to connect communications terminal devices to the ATM-based communications network ATM-KN, are connected

to the ATM-based communications network ATM-KN. Communications terminal devices KE1,..., KEn are shown as examples.

Via an ATM transfer unit, ISDN communications terminal devices (Integrated Services Digital Network) are normally connected ~~by means of~~ via S_0 interfaces, or digital communications terminal devices are normally connected ~~by means of~~ via interfaces derived therefrom, ~~for example~~ such as U_{p0} interfaces, to the ATM-based communications network ATM-KN. Generally, an S_0 interface or a U_{p0} interface ~~comprises~~ includes, on the one hand, 2 user data channels which are designed as ISDN-oriented B-channels with a transmission bit rate in each case of 64 kbit/s and, on the other hand, a signaling channel, which is designed as an ISDN-oriented D-channel with a transmission bit rate of 16 kbit/s. Furthermore, the possibility generally exists for connecting analog communications terminal devices via a/b interfaces to the ATM-based communications network ATM-KN.

The communications terminal devices KE1,...,KEn are connected to the ATM transfer unit ATM-HUB, i.e., the subscriber interfaces are provided by the ATM transfer unit ATM-HUB according to the terminology of the ITU-T G.960 standard ~~by means of~~ via network terminations NT (Network Termination). According to the ITU-T G.960 standard (International Telecommunication Union), the network terminations NT of an ATM transfer unit ATM-HUB are connected via a line termination LT disposed in the ATM transfer unit ATM-HUB to the exchange termination device ET of the switching system PBX. For data transmission via the ATM-based communications network ATM-KN, the line termination LT, corresponding to the exchange termination device ET of the switching system PBX, is connected via a connection unit AE to the ATM-based communications network ATM-KN.

A two-way conversion between the time-slot-oriented IOM-2 data format, normally provided for data transmission between the exchange termination device and the line termination, and the packet-oriented ATM data format according to the fifth ATM adaptation layer AAL5 is carried out by the connection units AE.

Fig. 3 shows a schematic representation of an ATM cell subdivided into subpackets according to the fifth ATM adaptation layer AAL5. The ATM adaptation

layer AAL (ATM Adaptation Layer) serves to adapt the ATM cell format (Layer 2 of the OSI reference model) to the network layer (Layer 3) of the OSI reference model (Open System Interconnection).

An ATM cell ATMZ generally ~~comprises~~ includes a five-byte cell header H, frequently referred to ~~in the literature~~ as the "header" - containing switching data relevant to the transport of an ATM cell ATMZ and a 48-byte user data field N, frequently referred to ~~in the literature~~ as the "payload". In the case of an ATM cell ATMZ subdivided according to the fifth ATM adaptation layer AAL5, the user data area N is subdivided into at least one first subpacket TP1 and into a second subpacket TP2. First subpackets TP1 are shown in Figure 4 as examples.

A first subpacket TP1 is, in turn, subdivided into a 1-byte packet cell header SH and into a user data field of a defined length. The packet cell header SH ~~comprises~~ includes a 3-bit segment identifier CI, also ~~frequently~~ referred to as the "channel identifier" and a 5-bit length identifier LI, also ~~frequently~~ referred to as the "length identifier". ~~By means of~~ Via the 5-bit length identifier LI, user data fields of the first subpackets TP1 with a length n of $2^5 = 32$ bytes can essentially be defined. However, the first subpackets TP1 advantageously have a length of 10 bytes. Correspondence with the ATM Forum standard af-vtoa-0083.000, "Voice and Telephony over ATM to the Desktop Specification", 5/1997, is thereby achieved, in which a maximum user data field length of 40 bytes is provided for data transmission according to the fifth ATM adaptation layer AAL5.

The second subpacket TP2 is preferably used for the transport of dummy data L, but can also be used for what is frequently referred to ~~in the literature~~ as a cyclic redundancy check CRC. The length of the second subpacket TP2 is selected in such a way that the total length of the first data packets TP1 transmitted in an ATM cell ATMZ and the second subpacket TP2 corresponds to the length of the user data area N of the ATM cell ATMZ, i.e., 48 bytes. However, the length of a second subpacket TP2 for adaptation to the af-vtoa-0083.000 standard of the ATM Forum is at least 8 bytes.

Fig. 4 shows, in a schematic representation, the conversion of the time-slot-

oriented IOM-2 data format into the packet-oriented ATM data format according to the fifth ATM adaptation layer AAL5. In a conversion from the time-slot-oriented IOM-2 data format to the packet-oriented ATM data format, a unique VPI/VCI address is allocated to each subframe CHx for transmission via the ATM-based communications network ATM-KN~~,~~ i.e.~~,~~ data allocated to different subframes CHx are transmitted in separate ATM cells ATMZ with a unique VPI/VCI address stored in the cell header H of the ATM cell ATMZ~~,~~ shown as an example for the subframe CH0.

In the fifth ATM adaptation layer AAL5, as already described above, the user data area N of an ATM cell ATMZ can be subdivided into first and second subpackets TP1, TP2. ~~By means of~~ Via the subdivision of an ATM cell ATMZ into first and second subpackets TP1, TP2, a ~~plurality~~ number of channels can be defined within an ATM connection ~~by means of~~ via the 3-bit segment identifier CI and are all provided with the same ATM address~~,~~ ~~comprising~~ which includes a VPI value and a VCI value. Here, for example, a CI address 011 is selected for the first user data channel B1, a CI address 100 for the second user data channel B2, a CI address 010 for the monitor channel M and a CI address 001 for the control channel D. In data transmission between the switching system PBX and an ATM transfer unit ATM-HUB, in particular an exchange termination device ET and a line termination LT, the possibility thus exists for data to be transmitted only of those channels (the first user data channel B1, the second user data channel B2,
the monitor channel M and the control channel D) via which data ~~are~~ is actually currently being transmitted.

In the present embodiment, one first subpacket TP1 of identical length is in each case defined successively for the first user data channel B1, the second user data channel B2, the monitor channel M and the control channel D of a subframe CHx~~,~~ shown for the subframe CH0 as an example~~,~~ and is transmitted in the user data area of the ATM cell ATMZ. Four first subpackets TP1 with a respective length of 10 bytes are shown as examples in ~~the figure~~ Fig. 4. Following the first subpacket TP1 allocated to the control channel C, a second subpacket TP2 is transmitted. The length of the second subpacket TP2 is selected in this case in such a way that the total length of the

first data packets TP1 transmitted in an ATM cell ATMZ and the second subpacket TP2 corresponds to the length of the user data area N of the ATM cell ATMZ~~,~~ i.e.~~,~~ 48 bytes. In the present embodiment, the second subpacket TP2 thus has a length of 8 bytes.

The communications terminal devices KE1, ..., KEn can be connected to the switching system PBX via the ATM-based communications network ATM-KN according to two different connection types, which are described in more detail below.

According to a first connection type, a "dedicated connection" based on the fifth ATM adaptation layer AAL5 is set up in each case between the switching system PBX and the ATM transfer units ATM-HUB of the ATM-based communications network ATM-KN, a definable transmission bit rate being guaranteed for a predefinable period for the dedicated connection. In the ATM-based communications network ATM-KN, this corresponds to the setting up in each case of a virtual connection between the switching system PBX and the ATM transfer units ATM-HUB of the ATM-based communications network ATM-KN~~,~~ which may, if necessary, also contain a ~~plurality~~ number of virtual transmission channels.

The dedicated connection is set up here by administrative measures, wherein a transmission channel (frequently referred to ~~in the literature~~ as a ~~"~~"Virtual Channel Connection~~"~~" VCC) can be individually allocated to each communications terminal device KE1,..., KEn connected via the ATM-based communications network ATM-KN to the switching system PBX.

Fig. 5 shows a flowchart to illustrate the ~~essential~~ method steps which take place during data transmission between a communications terminal device KE1,..., KEn and the switching system PBX while a dedicated connection exists between the switching system PBX and the ATM transfer unit ATM-HUB which provides the connection unit AE for the relevant communications terminal device KE1,..., KEn. Starting with the communications terminal device KE1,..., KEn in idle mode, in the event of a request for a connection to the communications terminal device KE1,..., KEn, what is frequently referred to in the literature as the ~~"~~"Home PBX~~"~~" of the communications terminal device KE1,..., KEn, i.e. the switching system PBX to

which the communications terminal device KE1,..., KEn is registered, is identified by the corresponding ATM transfer unit ATM-HUB. The transmission channel VCC allocated to the communications terminal device KE1,..., KEn for data transmission via the ATM-based communications network ATM-KN is then determined, thereby providing a virtual connection via the ATM-based communications network ATM-KN during the already existing dedicated connection. Through the use of a connection based on the fifth ATM adaptation layer AAL5, the possibility exists for transmitting via the connection only data of the channels of the IOM-2 data format via which data are currently to be transmitted.

In a subsequent step, the signaling information required in order to set up a connection between the communications terminal device KE1,..., KEn and the switching system PBX is transmitted via the control channel D of the IOM-2 data format~~,~~; i.e., a logical connection is set up between the communications terminal device KE1,..., KEn and the switching system PBX. The two-way user data transmission then takes place between the communications terminal device KE1,..., KEn and the switching system PBX via one or, alternatively, ~~via~~ both user data channels B1, B2 of the IOM-2 data format. If the logical connection is subsequently to be cleared down between the communications terminal device KE1,..., KEn and the switching system PBX, for example~~,~~ as a result of a handset going on-hook on the communications terminal device KE1,..., Ken, ~~this~~ it is carried out ~~by means of~~ via corresponding signaling between the communications terminal device KE1,..., KEn and the switching system PBX via the control channel D. At the end of the connection, the communications terminal device KE1,..., KEn reverts to idle mode~~,~~; i.e., no transmission resources are withdrawn from the ATM-based communications network ATM-KN by the transmission channel VCC.

However, dedicated connections of this type can be set up in a communications network in a limited number only, depending on the size and available transmission bandwidth of this communications network. Furthermore, with changing communications relationships between the communications units involved, all communications and data connections concerned (in an ATM-based communications

network, all virtual transmission channels contained in a virtual path) must be taken into account. As a result, the administrative outlay for dedicated connections of this type increases very rapidly with the size of the communications network.

In order to reduce the administrative outlay, the communications terminal devices KE1,..., KEn can be connected alternatively to the switching system PBX according to a second connection type ~~by means of~~ via "signaled connections", i.e., a connection between the switching system PBX and the ATM transfer unit ATM-HUB which provides the connection unit AE for the relevant communications terminal device KE1,..., Ken via the ATM-based communications network ATM-KN is set up only when data transmission is actually to take place. The consequence of this, however, in contrast to the dedicated connections described, is that the "signaling load" in the ATM-based communications network ATM-KN increases.

Fig. 6 shows a flowchart illustrating the ~~essential~~ method steps which take place during data transmission between a communications terminal device KE1,..., KEn and the switching system PBX during a signaled connection. Starting with the communications terminal device KE1,..., KEn in idle mode, in the event of a request for a connection to the communications terminal device KE1,..., KEn, the "Home PBX" of the communications terminal device KE1,..., KEn is identified by the corresponding ATM transfer unit ATM-HUB. A connection based on the fifth ATM adaptation layer AAL5 is then set up by the ATM transfer unit ATM-HUB to the channels required for the IOM-2 data format (the first user data channel B1, the second user data channel B2, the monitor channel M and the control channel D) between the ATM transfer unit ATM-HUB and the switching system PBX via the ATM-based communications network ATM-KN. Once it has been set up, this connection is made available to the communications terminal device KE1,..., KEn for data transmission between the communications terminal device KE1,..., KEn and the switching system PBX. Through the use of a connection based on the fifth ATM adaptation layer AAL5, the possibility exists for transmitting via the connection only data of the channels of the IOM-2 data format via which data ~~are~~ is currently to be transmitted.

In a subsequent step, the signaling information required in order to set up a

connection between the communications terminal device KE1,..., KEn and the switching system PBX is transmitted via the control channel D~~,~~ i.e.~~,~~ a logical connection is set up between the communications terminal device KE1,..., KEn and the switching system PBX. The two-way user data transmission then takes place between the communications terminal device KE1,..., KEn and the switching system PBX via one or, alternatively, ~~via~~ both user data channels B1, B2. If the logical connection is subsequently to be cleared down between the communications terminal device KE1,..., KEn and the switching system PBX~~,~~ for example~~,~~ as a result of a handset going on-hook on the communications terminal device KE1,..., Ken~~,~~ ~~this~~ it is carried out ~~by means of~~ via corresponding signaling between the communications terminal device KE1,..., KEn and the switching system PBX via the control channel D. Finally, the ATM transfer unit ATM-HUB again clears down the connection between the switching system PBX and the ATM transfer unit ATM-HUB via the ATM-based communications network ATM-KN. The communications terminal device KE1,..., KEn then reverts to idle mode.

Although the present invention has been described with reference to specific embodiments, those of skill in the art will recognize that changes may be made thereto without departing from the spirit and scope of the invention as set forth in the hereafter appended claims.

~~Abstract~~

ABSTRACT OF THE DISCLOSURE

~~Method for data transmission via a packet-oriented communications network~~

~~In the present communications system~~ A method for data transmission via a packet-oriented communications network, wherein, communications terminal devices ~~(KE1,..., KEn)~~ are connected to ~~a~~ the packet-oriented communications network ~~(ATM-KN)~~ via at least one transfer unit ~~(ATM-HUB)~~ and a switching system ~~(PBX)~~. To transmit data between the switching system ~~(PBX)~~ and the communications terminal devices ~~(KE1,..., KEn)~~, a time-slot-oriented data format ~~(IOM-2)~~ is provided, which is formed from a periodic sequence of channel-specific information segments ~~(B1, B2, M, D)~~. For the transmission of data via the communications network ~~(ATM-KN)~~, a user data area ~~(N)~~ of a data packet ~~(ATMZ)~~ used to transmit data via the communications network ~~(ATM-KN)~~ is subdivided into at least one first subpacket ~~(TP1)~~ and into a second subpacket ~~(TP2)~~, data of a channel-specific information segment ~~(B1, B2, M, D)~~ being transmitted in each case in the first subpackets ~~(TP1)~~.

~~Fig. 2~~

Description

Method for data transmission via a packet-oriented communications network

The invention relates to a method for data transmission between two communications devices via a packet-oriented communications network according to the preamble to claim 1. The invention relates in particular to a transmission system for transmitting time-slot-oriented data between an exchange termination device ET and a line termination LT. According to the terminology of the ITU-T G.960 (3/93) standard, "access digital section for ISDN basic rate access" (International Telecommunication Union), in particular pages 2 and 3, the invention correspondingly relates to data transmission on the "V reference point".

A method is known, for example, from US patent specification US-A-5793766 for two-way data transmission between communications devices supporting a time-slot-oriented data transmission protocol - comprising channel-specific information segments - via a packet-oriented communications network. Here, the data packets used to transmit data via the packet-oriented communications network are subdivided into a first sub-packet and into a second sub-packet, data of different channel-specific information segments in each case being transmitted in a first data packet.

A transmission system for transmitting time-slot-oriented data between an exchange termination device and a line termination normally forms part of a communications system which has a switching device and subscriber connection devices. The subscriber connection

devices have subscriber interfaces for connecting communications terminal devices to the communications system. According to the ITU-T G.960 standard, the subscriber connection devices are connected via a line termination and an exchange termination device to the switching device of the communications system. A communications system of this type serves to set up or clear down narrowband communications connections between communications terminal devices connected to the subscriber connection devices and to enable narrowband communication - for example, voice or data communication - between the communications terminal devices.

In modern communications systems, data transmission normally takes place between the exchange termination device and the line termination on the basis of the time-slot-oriented data format IOM-2 (ISDN Oriented Modular Interface), which is formed from a periodic sequence of channel-specific information segments - referred to below as the time division multiplex channel. One time division multiplex channel is normally allocated in each case to each subscriber interface of a subscriber connection device.

In modern communications technology, there is a need for broadband transmission of information, for example still and moving pictures in videotelephony applications or large data volumes on the Internet. This increases the importance of transmission technology for high and variable data transmission rates (greater than 100 Mbit/s), which take account both of data transmission requirements (high speed with variable transmission bit rate) and voice data transmission requirements (maintenance of temporal correlations in the case of data transmission via a network), in order to be able to integrate the separate networks currently existing for the different purposes into one network. A known data transmission method for high data speeds is referred to as Asynchronous Transfer Mode (ATM). Data transmission on the basis of the Asynchronous Transfer Mode currently enables a variable transmission bit rate of up to 622 Mbit/s.

In the cell-based data transmission method known as Asynchronous Transfer Mode (ATM), fixed-length data packets, referred to as ATM cells, are used for data transport. An ATM cell comprises a five-byte cell header containing switching data relevant to the transport of an ATM cell, and a 48-byte user data field, referred to as the 'payload'.

Data transmission via an ATM-based communications network generally takes place in "virtual paths" or in virtual channels contained in the virtual paths. To do this, connection tables with switching information comprising a "virtual channel identifier" and a "virtual path identifier" are created when a connection is set up, before the start of the actual user data transmission, by exchanging signaling information in the respective ATM network nodes of the ATM-based communications network. In the connection tables, a "VCI value" is allocated to the virtual channel identifier and a "VPI value" is allocated to the virtual path identifier. The switching information recorded in the connection table of an ATM network node determines how the virtual paths or virtual channels contained in the virtual paths of the incoming and outgoing connections on the ATM network node are allocated to one another by the signaling, i.e. which input is linked by the switching system to which output of the ATM network node. The cell header of ATM cells transmitted via these virtual connections (virtual paths and virtual channels) essentially contains switching data comprising a VPI value and a VCI value. The ATM cell header data are processed at the input of an ATM network node, i.e. the switching data disposed therein are collected and evaluated. The ATM cells are then switched through the ATM network node using the switching information stored in the connection table to an output of the ATM network node representing a specific destination.

In the German patent application with the official reference 198 45 038.9, a transmission system between an exchange termination device and a line termination has already been proposed in which the transmission is implemented via an ATM-based communications network. Here, subscriber interfaces are made available in order to connect

communications terminal devices by means of ATM transfer units - frequently referred to in the literature as the "ATM hub" - which are connected to the ATM-based communications network. The exchange termination device of the communications system and the line termination implemented by the ATM transfer unit in each case have an ATM connection unit, via which, on the one hand, a connection to the ATM-based communications network is implemented and, on the other hand, a two-way conversion is carried out between the IOM-2 data format, normally provided for data transmission between the exchange termination device and the line termination, and the ATM data format.

The two-way conversion between the time-slot-oriented IOM-2 data format and the cell-based ATM data format takes place according to two different conversion methods. According to the first conversion method, on the basis of the specification CES 2.0 of the ATM Forum, the time-slot-oriented data are packeted byte-by-byte in ATM cells according to the first ATM adaptation layer AAL1. The ATM adaptation layer AAL (ATM Adaptation Layer) serves to adapt the ATM data format (corresponding to Layer 2 of the OSI reference model) to the network layer (Layer 3) of the OSI reference model (Open System Interconnection). According to the second conversion method, the time-slot-oriented data are packeted byte-by-byte into ATM cells substructured according to the second ATM adaptation layer AAL2.

The object of the present invention is to indicate an alternative method, by means of which two-way data transmission can take place between the communications terminal devices and the switching system.

The object is achieved on the basis of the features of the preamble to claim 1 by means of the latter's characterizing features.

For a better understanding of the mode of operation of the transmission of time-slot-oriented data between an exchange termination device and a line termination, it appears necessary to begin by re-examining known principles in more detail.

Transmission of the time-slot-oriented data between the exchange termination device and the line termination normally takes place, for example, on the basis of the IOM-2 data format known from the product document entitled "ICs for Communications - IOM®-2 Interface Reference Guide" from Siemens, Munich, 3/91, Order No. B115-H6397-X-X-7600, in particular pages 6 to 12.

A more rapid understanding of the relationships is provided by Fig. 1, which shows a schematic representation of the IOM-2 data format according to which time division multiplex frames IOM-R with a length of 125 µs are periodically transmitted. A time division multiplex frame IOM-R of this type is divided up into time division multiplex channels or subframes CH0,.., CH7 - also frequently referred to in the literature simply as 'channels'. The subframes CH0,.., CH7 are in turn subdivided in each case into two 8-bit user data channels B1, B2, into one 8-bit monitor channel M, into one 2-bit control information channel DI, into one 4-bit status channel C/I (Command/Indicate) and into in each case two 1-bit monitor status channels MR, MX. The control information channel DI, the status channel C/I and the two monitor status channels MR, MX are normally referred to jointly as the control channel D.

User data are transmitted via the user data channels B1, B2 between devices connected to an IOM-2 bus at a transmission bit rate in each case of 64 kbit/s. Control information allocated to the user data is transmitted via the control information channel D at a transmission bit rate of 16 kbit/s. The monitor channel serves,

inter alia, to configure devices connected to an IOM-2 bus

on the basis of an 'IOM-2 bus master'. The monitor status channels MR (Monitor Read) and MX (Monitor Transmit) serve to determine whether data from a device connected to the IOM-2 bus are read by the IOM-2 bus (MR = 1, MX = 0) or are output onto the IOM-2 bus (MR = 0, MX = 1). Information relating to real-time requirements which exist during data transmission between two devices connected to an IOM-2 bus are exchanged via the status channel C/I.

In the case of data transmission via an ATM-based communications network by means of ATM cells according to the first ATM adaptation layer AAL1, only one constant transmission bit rate can be implemented between the switching system and an ATM transfer unit since, irrespective of whether data are or are not actually transmitted, all channel information - of the two user data channels B1, B2 , the monitor channel M and the control channel D - of the IOM-2 data format must be transmitted. On the other hand, in the case of data transmission via the ATM-based communications network by means of ATM cells according to the second ATM adaptation layer AAL2, a variable transmission bit rate can be implemented between the switching system and an ATM transfer unit, since the possibility exists for transmitting only individual channel information which is currently transmitting data.

An essential advantage of the method according to the invention is that the method can be implemented in a simple manner in already existing systems without modifications being necessary at the interface between the switching system and the ATM transfer unit - referred to as the V reference point according to the terminology of the ITU-T G.960 standard.

Advantageous further developments of the invention are indicated in the subclaims.

One advantage of designs of the invention defined in the subclaims is, inter alia, that, through sub-structuring into subpackets of the user data area of a data packet used for data transmission, to which channel-specific information of the time-slot-oriented data format can in each case be allocated, a variable transmission bit rate can be implemented in a simple manner between the switching system and the transfer units through non-transmission of individual subpackets containing no user data.

A further advantage of designs of the invention defined in the subclaims is that, for two-way conversion between the time-slot-oriented IOM-2 data format and the packet-oriented ATM data format according to the fifth ATM adaptation layer AAL5, already existing AAL5 components can be used, so that no new developments are required.

A further advantage of designs of the invention defined in the subclaims is that, by means of data transmission between a communications terminal device and the switching system via an existing dedicated connection between the switching system (PBX) and the ATM transfer unit via which the communications terminal device is connected to the ATM-based communications network, or, alternatively, via a connection individually set up for this data transmission, the 'signaling load' or the administrative outlay can be adapted in a simple manner to current circumstances in or for the communications network.

An embodiment of the invention is explained in more detail below with reference to the drawing, in which:

Fig. 2 shows a structural diagram schematically representing the essential functional units involved in the method according to the invention;

Fig. 3 shows a structural diagram schematically representing an ATM cell subdivided into subpackets;

Fig. 4 shows a structural diagram schematically representing the conversion of the time-slot-oriented IOM-2 data format into the ATM data format according to the fifth ATM adaptation layer AAL5;

Fig. 5 shows a flowchart illustrating the essential method steps which take place during data transmission according to a first connection type of the communications terminal devices;

Fig. 6 shows a flowchart illustrating the essential method steps which take place during data transmission according to a second connection type of the communications terminal devices.

Fig. 2 shows a schematic representation of a switching system PBX (Private Branch Exchange) with an exchange termination unit ET (Exchange Termination) disposed therein. The exchange termination unit ET is connected via a connection unit AE to an ATM-based communications network ATM-KN. Furthermore, ATM transfer units ATM-HUB, which have subscriber interfaces to connect communications terminal devices to the ATM-based communications network ATM-KN, are connected to the ATM-based communications network ATM-KN. Communications terminal devices KE1,…, KEn are shown as examples.

Via an ATM transfer unit, ISDN communications terminal devices (Integrated Services Digital Network) are normally connected by means of S_0 interfaces, or digital communications terminal devices are normally connected by means of interfaces derived therefrom, for example U_{p0} interfaces, to the ATM-based communications network ATM-KN. Generally, an S_0 interface or a U_{p0} interface comprises, on the one hand, 2 user data channels which

are designed as ISDN-oriented B-channels with a transmission bit rate in each case of 64 kbit/s and, on the other hand, a signaling channel, which is designed as an ISDN-oriented D-channel with a transmission bit rate of 16 kbit/s. Furthermore, the possibility generally exists for connecting analog communications terminal devices via a/b interfaces to the ATM-based communications network ATM-KN.

The communications terminal devices KE1,...,KEn are connected to the ATM transfer unit ATM-HUB, i.e. the subscriber interfaces are provided by the ATM transfer unit ATM-HUB according to the terminology of the ITU-T G.960 standard by means of network terminations NT (Network Termination). According to the ITU-T G.960 standard (International Telecommunication Union), the network terminations NT of an ATM transfer unit ATM-HUB are connected via a line termination LT disposed in the ATM transfer unit ATM-HUB to the exchange termination device ET of the switching system PBX. For data transmission via the ATM-based communications network ATM-KN, the line termination LT - corresponding to the exchange termination device ET of the switching system PBX - is connected via a connection unit AE to the ATM-based communications network ATM-KN.

A two-way conversion between the time-slot-oriented IOM-2 data format, normally provided for data transmission between the exchange termination device and the line termination, and the packet-oriented ATM data format according to the fifth ATM adaptation layer AAL5 is carried out by the connection units AE.

Fig. 3 shows a schematic representation of an ATM cell subdivided into subpackets according to the fifth ATM adaptation layer AAL5. The ATM adaptation layer AAL (ATM Adaptation Layer) serves to adapt the ATM cell format (Layer 2 of the OSI reference model) to the network

layer (Layer 3) of the OSI reference model (Open System Interconnection).

An ATM cell ATMZ generally comprises a five-byte cell header H - frequently referred to in the literature as the 'header' - containing switching data relevant to the transport of an ATM cell ATMZ and a 48-byte user data field N - frequently referred to in the literature as the 'payload'. In the case of an ATM cell ATMZ subdivided according to the fifth ATM adaptation layer AAL5, the user data area N is subdivided into at least one first subpacket TP1 and into a second subpacket TP2. First subpackets TP1 are shown in Figure 4 as examples.

A first subpacket TP1 is in turn subdivided into a 1-byte packet cell header SH and into a user data field of a defined length. The packet cell header SH comprises a 3-bit segment identifier CI - also frequently referred to as the 'channel identifier' - and a 5-bit length identifier LI - also frequently referred to as the 'length identifier'. By means of the 5-bit length identifier LI, user data fields of the first subpackets TP1 with a length n of 2^5 = 32 bytes can essentially be defined. However, the first subpackets TP1 advantageously have a length of 10 bytes. Correspondence with the ATM Forum standard af-vtoa-0083.000, "Voice and Telephony over ATM to the Desktop Specification", 5/1997, is thereby achieved, in which a maximum user data field length of 40 bytes is provided for data transmission according to the fifth ATM adaptation layer AAL5.

The second subpacket TP2 is preferably used for the transport of dummy data L, but can also be used for what is frequently referred to in the literature as a cyclic redundancy check CRC. The length of the second subpacket TP2 is selected in such a way that the total length of the first data packets TP1 transmitted in an

ATM cell ATMZ and the second subpacket TP2 corresponds to the length of the user data area N of the ATM cell ATMZ, i.e. 48 bytes. However, the length of a second subpacket TP2 for adaptation to the af-vtoa-0083.000 standard of the ATM Forum is at least 8 bytes.

Fig. 4 shows, in a schematic representation, the conversion of the time-slot-oriented IOM-2 data format into the packet-oriented ATM data format according to the fifth ATM adaptation layer AAL5. In a conversion from the time-slot-oriented IOM-2 data format to the packet-oriented ATM data format, a unique VPI/VCI address is allocated to each subframe CHx for transmission via the ATM-based communications network ATM-KN, i.e. data allocated to different subframes CHx are transmitted in separate ATM cells ATMZ with a unique VPI/VCI address stored in the cell header H of the ATM cell ATMZ - shown as an example for the subframe CH0.

In the fifth ATM adaptation layer AAL5, as already described above, the user data area N of an ATM cell ATMZ can be subdivided into first and second subpackets TP1, TP2. By means of the subdivision of an ATM cell ATMZ into first and second subpackets TP1, TP2, a plurality of channels can be defined within an ATM connection by means of the 3-bit segment identifier CI and are all provided with the same ATM address - comprising a VPI value and a VCI value. Here, for example, a CI address 011 is selected for the first user data channel B1, a CI address 100 for the second user data channel B2, a CI address 010 for the monitor channel M and a CI address 001 for the control channel D. In data transmission between the switching system PBX and an ATM transfer unit ATM-HUB, in particular an exchange termination device ET and a line termination LT, the possibility thus exists for data to be transmitted only of those channels - the first user

data channel B1, the second user data channel B2,

the monitor channel M and the control channel D - via which data are actually currently being transmitted.

In the present embodiment, one first subpacket TP1 of identical length is in each case defined successively for the first user data channel B1, the second user data channel B2, the monitor channel M and the control channel D of a subframe CHx - shown for the subframe CH0 as an example - and is transmitted in the user data area of the ATM cell ATMZ. Four first subpackets TP1 with a respective length of 10 bytes are shown as examples in the figure. Following the first subpacket TP1 allocated to the control channel C, a second subpacket TP2 is transmitted. The length of the second subpacket TP2 is selected in this case in such a way that the total length of the first data packets TP1 transmitted in an ATM cell ATMZ and the second subpacket TP2 corresponds to the length of the user data area N of the ATM cell ATMZ, i.e. 48 bytes. In the present embodiment, the second subpacket TP2 thus has a length of 8 bytes.

The communications terminal devices KE1, ..., KEn can be connected to the switching system PBX via the ATM-based communications network ATM-KN according to two different connection types, which are described in more detail below.

According to a first connection type, a "dedicated connection" based on the fifth ATM adaptation layer AAL5 is set up in each case between the switching system PBX and the ATM transfer units ATM-HUB of the ATM-based communications network ATM-KN, a definable transmission bit rate being guaranteed for a predefinable period for the dedicated connection. In the ATM-based communications network ATM-KN, this corresponds to the setting up in each case of a virtual connection between the switching system PBX and the ATM transfer units ATM-HUB of the ATM-based communications

network ATM-KN, which may, if necessary, also contain a plurality of virtual transmission channels.

The dedicated connection is set up here by administrative measures, wherein a transmission channel - frequently referred to in the literature as a 'Virtual Channel Connection' VCC - can be individually allocated to each communications terminal device KE1,..., KEn connected via the ATM-based communications network ATM-KN to the switching system PBX.

Fig. 5 shows a flowchart to illustrate the essential method steps which take place during data transmission between a communications terminal device KE1,..., KEn and the switching system PBX while a dedicated connection exists between the switching system PBX and the ATM transfer unit ATM-HUB which provides the connection unit AE for the relevant communications terminal device KE1,..., KEn. Starting with the communications terminal device KE1,..., KEn in idle mode, in the event of a request for a connection to the communications terminal device KE1,..., KEn, what is frequently referred to in the literature as the 'Home PBX' of the communications terminal device KE1,..., KEn, i.e. the switching system PBX to which the communications terminal device KE1,..., KEn is registered, is identified by the corresponding ATM transfer unit ATM-HUB. The transmission channel VCC allocated to the communications terminal device KE1,..., KEn for data transmission via the ATM-based communications network ATM-KN is then determined, thereby providing a virtual connection via the ATM-based communications network ATM-KN during the already existing dedicated connection. Through the use of a connection based on the fifth ATM adaptation layer AAL5, the possibility exists for transmitting via the connection only data of the channels of the IOM-2 data format via which data are currently to be transmitted.

In a subsequent step, the signaling information required in order to set up a connection between the communications terminal device KE1,..., KEn and the switching system PBX is transmitted via the control

channel D of the IOM-2 data

format, i.e. a logical connection is set up between the communications terminal device KE1,..., KEn and the switching system PBX. The two-way user data transmission then takes place between the communications terminal device KE1,..., KEn and the switching system PBX via one or, alternatively, via both user data channels B1, B2 of the IOM-2 data format. If the logical connection is subsequently to be cleared down between the communications terminal device KE1,..., KEn and the switching system PBX - for example, as a result of a handset going on-hook on the communications terminal device KE1,..., KEn - this is carried out by means of corresponding signaling between the communications terminal device KE1,..., KEn and the switching system PBX via the control channel D. At the end of the connection, the communications terminal device KE1,..., KEn reverts to idle mode, i.e. no transmission resources are withdrawn from the ATM-based communications network ATM-KN by the transmission channel VCC.

However, dedicated connections of this type can be set up in a communications network in a limited number only, depending on the size and available transmission bandwidth of this communications network. Furthermore, with changing communications relationships between the communications units involved, all communications and data connections concerned - in an ATM-based communications network, all virtual transmission channels contained in a virtual path - must be taken into account. As a result, the administrative outlay for dedicated connections of this type increases very rapidly with the size of the communications network.

In order to reduce the administrative outlay, the communications terminal devices KE1,..., KEn can be connected alternatively to the switching system PBX according to a second connection type by means of "signaled connections", i.e. a connection between the

switching system PBX and the ATM transfer unit ATM-HUB which provides the connection unit AE for the relevant communications terminal device KE1,..., Ken

via the ATM-based communications network ATM-KN is set up only when data transmission is actually to take place. The consequence of this, however, in contrast to the dedicated connections described, is that the 'signaling load' in the ATM-based communications network ATM-KN increases.

Fig. 6 shows a flowchart illustrating the essential method steps which take place during data transmission between a communications terminal device KE1,..., KEn and the switching system PBX during a signaled connection. Starting with the communications terminal device KE1,..., KEn in idle mode, in the event of a request for a connection to the communications terminal device KE1,..., KEn, the 'Home PBX' of the communications terminal device KE1,..., KEn is identified by the corresponding ATM transfer unit ATM-HUB. A connection based on the fifth ATM adaptation layer AAL5 is then set up by the ATM transfer unit ATM-HUB to the channels required for the IOM-2 data format - the first user data channel B1, the second user data channel B2, the monitor channel M and the control channel D - between the ATM transfer unit ATM-HUB and the switching system PBX via the ATM-based communications network ATM-KN. Once it has been set up, this connection is made available to the communications terminal device KE1,..., KEn for data transmission between the communications terminal device KE1,..., KEn and the switching system PBX. Through the use of a connection based on the fifth ATM adaptation layer AAL5, the possibility exists for transmitting via the connection only data of the channels of the IOM-2 data format via which data are currently to be transmitted.

In a subsequent step, the signaling information required in order to set up a connection between the communications terminal device KE1,..., KEn and the switching system PBX is transmitted via the control channel D, i.e.

a logical connection is set up between the communications terminal device KE1,…, KEn and the switching system PBX. The two-way user data transmission then takes place between the communications terminal device KE1,…, KEn and the switching system PBX via one or, alternatively, via both user data channels B1, B2. If the logical connection is subsequently to be cleared down between the communications terminal device KE1,…, KEn and the switching system PBX - for example, as a result of a handset going on-hook on the communications terminal device KE1,…, KEn - this is carried out by means of corresponding signaling between the communications terminal device KE1,…, KEn and the switching system PBX via the control channel D. Finally, the ATM transfer unit ATM-HUB again clears down the connection between the switching system PBX and the ATM transfer unit ATM-HUB via the ATM-based communications network ATM-KN. The communications terminal device KE1,…, KEn then reverts to idle mode.

Claims

1. A method for data transmission between two communications devices via a packet-oriented communications network (ATM-KN),
a time-slot-oriented data format (IOM-2) formed from a periodic sequence of channel-specific information segments (B1, B2, M, D) being provided for data transmission between the communications devices,
characterized in that
for data transmission via the packet-oriented communications network (ATM-KN), a user data area (N) of a data packet (ATMZ) used for the data transmission is subdivided into at least one first subpacket (TP1) of a first length and into a second subpacket (TP2) of a second length, data of the same channel-specific information segment (B1, B2, M, D) being transmitted in each case in a first subpacket (TP1).

2. The method as claimed in claim 1,
characterized in that
the data transmission takes place between communications terminal devices (KE1,..., KEn) and a switching system (PBX), the communications terminal devices (KE1,..., KEn) being connected via at least one transfer unit (ATM-HUB) to the packet-oriented communications network (ATM-KN).

3. The method as claimed in claim 1 or 2,
characterized in that
a first subpacket (TP1) can be allocated in each case to the channel-specific information segments (B1, B2, M, D), the transmission of a first subpacket (TP1) being suppressible.

4. The method as claimed in one of the previous claims, characterized in that
dummy data are transmitted in the second subpacket (TP2), and
in that the length of the second subpacket (TP2) is selected in such a way that the total length of the transmitted first subpackets (TP1) and the second subpacket (TP2) corresponds to the length of the user data area (N) of the data packet (ATMZ).

5. The method as claimed in one of the previous claims, characterized in that
the second data packet (TP2) is at least 8 bytes long.

6. The method as claimed in one of the previous claims, characterized in that
the first subpackets (TP1) in each case have one cell header (SH) with a segment identifier (CI) and a length identifier (LI),
the respective first subpacket (TP1) being allocated by the segment identifier (CI) to a channel-specific information segment (B1, B2, M, D), and the number of data transmitted in the respective first subpacket (TP1) being defined by the length identifier (LI).

7. The method as claimed in one of the previous claims, characterized in that
the time-slot-oriented data format (IOM-2) is the standardized IOM-2 data format.

8. The method as claimed in one of the previous claims, characterized in that
data are transmitted via the packet-oriented communications network (ATM-KN) on the basis of the ATM data format (Asynchronous Transfer Mode).

9. The method as claimed in claim 8,
characterized in that
the two-way conversion between the time-slot-oriented data format (IOM-2) and the ATM data format is carried out according to an agreement known as the fifth ATM adaptation layer AAL5.

10. The method as claimed in claim 8 or 9,
characterized in that
data to be transmitted between a communications terminal device (KE1,..., KEn) and the switching system (PBX) are transmitted via an existing dedicated connection between the switching system (PBX) and the ATM transfer unit (ATM-HUB) via which the communications terminal device (KE1,..., KEn) is connected to the ATM-based communications network (ATM-KN).

11. The method as claimed in claim 8 or 9,
characterized in that
data to be transmitted between a communications terminal device (KE1,..., KEn) and the switching system (PBX) are transmitted via a connection individually set up for this data transmission between the switching system (PBX) and the ATM transfer unit (ATM-HUB) via which the communications terminal device (KE1,..., KEn) is connected to the ATM-based communications network (ATM-KN).

GR 98 P 8180

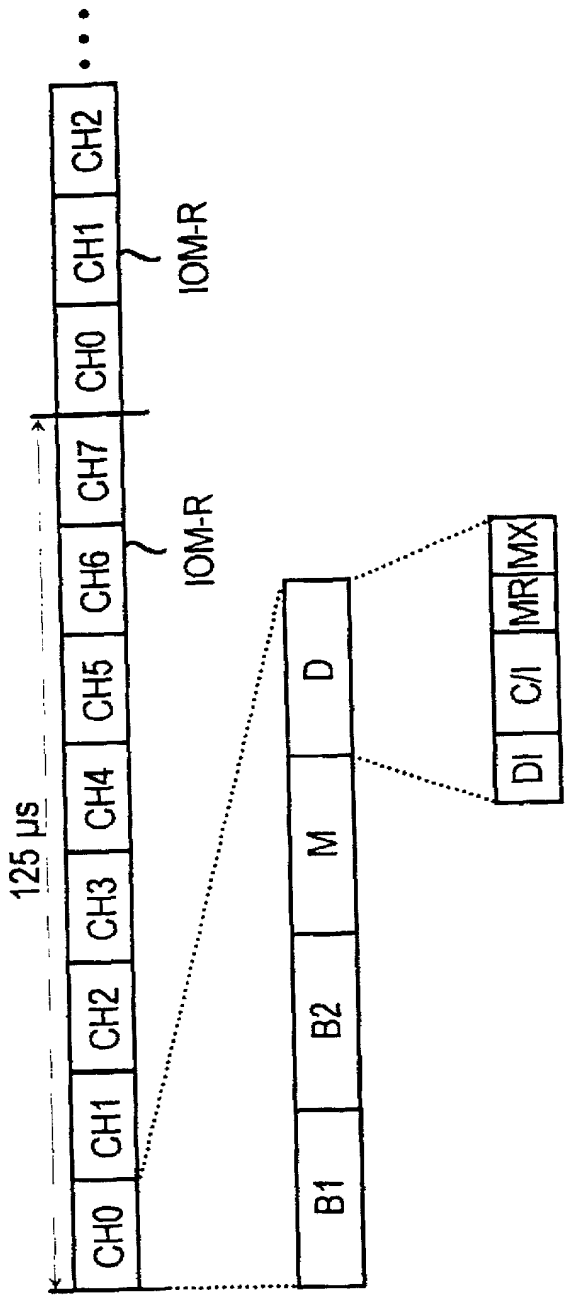
Abstract

Method for data transmission via a packet-oriented communications network

In the present communications system, communications terminal devices (KE1,…, KEn) are connected to a packet-oriented communications network (ATM-KN) via at least one transfer unit (ATM-HUB) and a switching system (PBX). To transmit data between the switching system (PBX) and the communications terminal devices (KE1,…, KEn), a time-slot-oriented data format (IOM-2) is provided, which is formed from a periodic sequence of channel-specific information segments (B1, B2, M, D). For the transmission of data via the communications network (ATM-KN), a user data area (N) of a data packet (ATMZ) used to transmit data via the communications network (ATM-KN) is subdivided into at least one first subpacket (TP1) and into a second subpacket (TP2), data of a channel-specific information segment (B1, B2, M, D) being transmitted in each case in the first subpackets (TP1).

Fig. 2

Fig 1



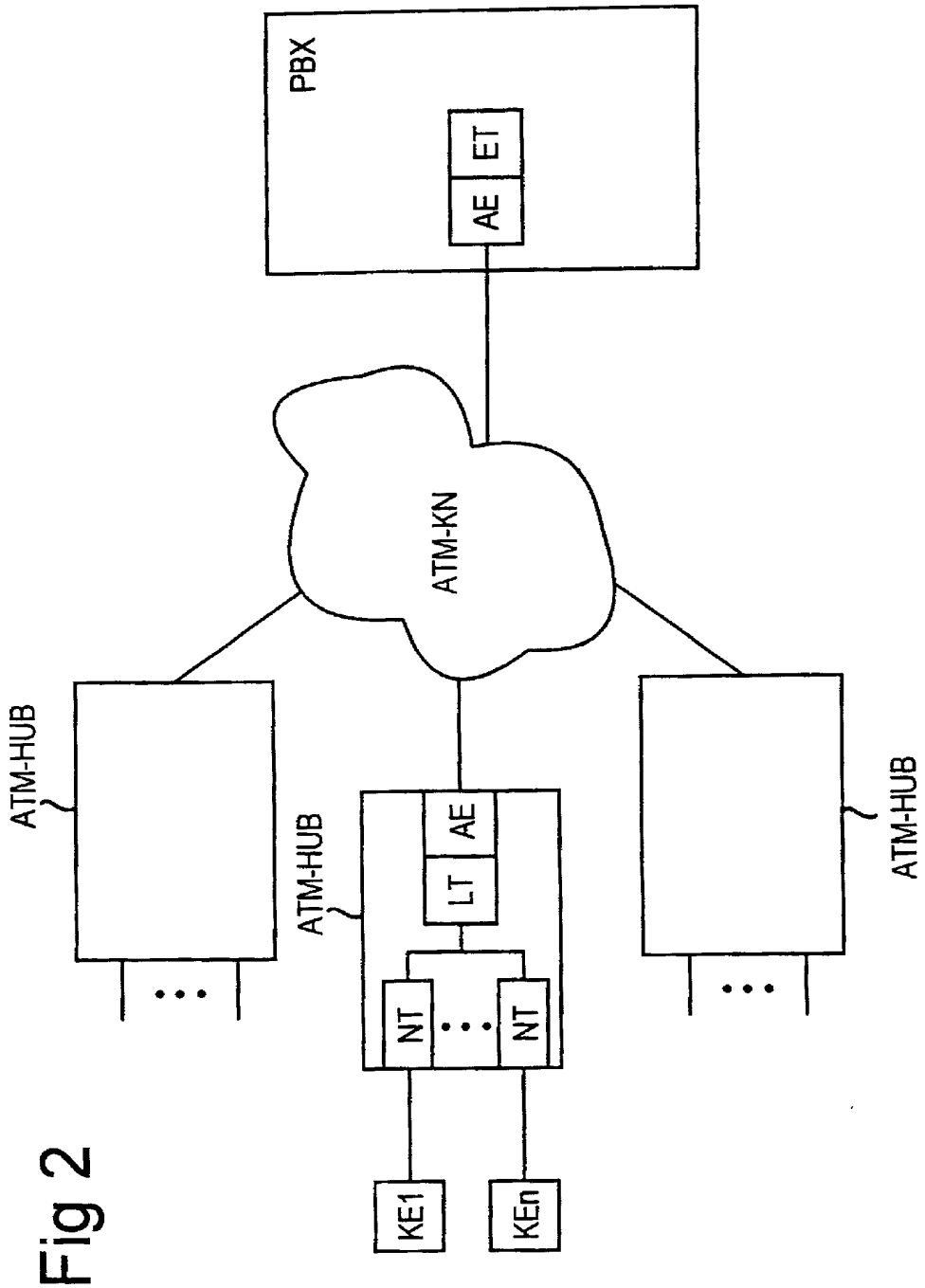


Fig 2

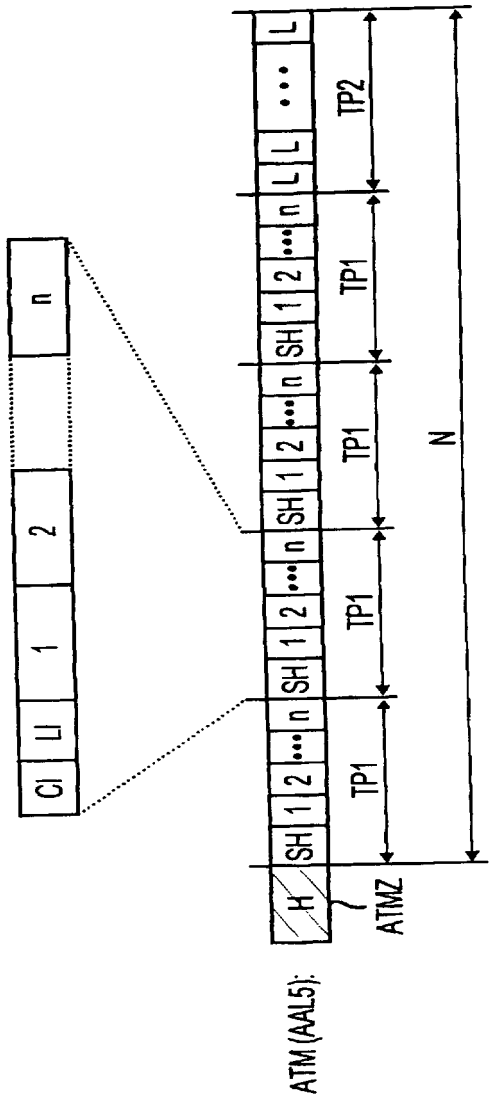


Fig 3

Fig 4

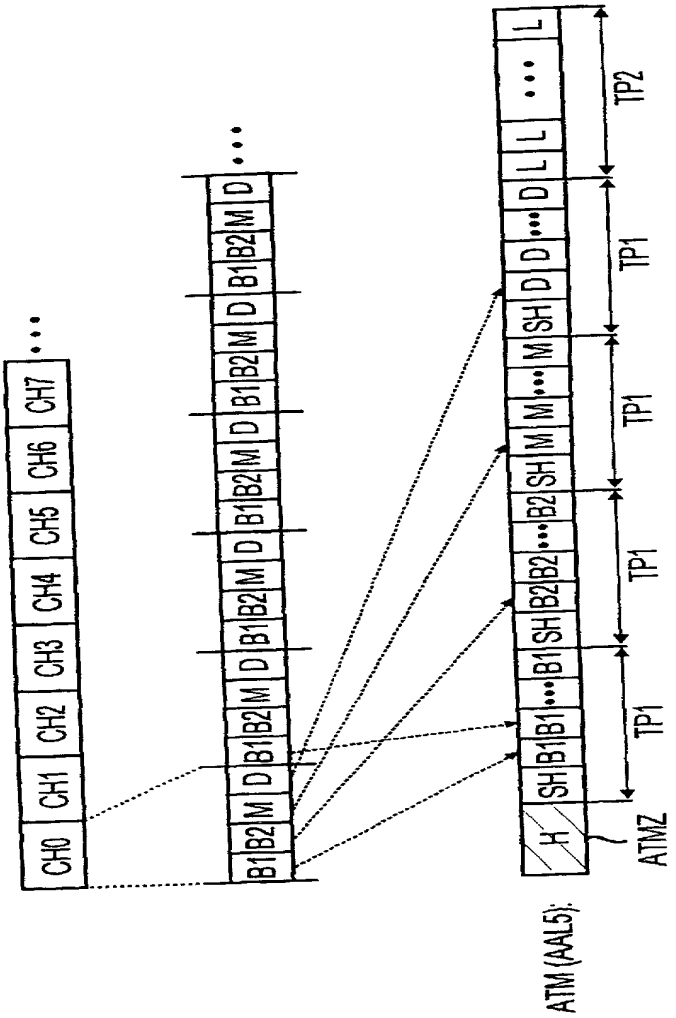

CH0
CH1
CH2
CH3
CH4
CH5
CH6
CH7
B1 B2 M D B1 B2 M D B1 B2 M D B1 B2 M D B1 B2 M D B1 B2 M D
ATM (AAL5):
H
SH B1 B1 ... B1 SH B2 B2 ... B2 SH M M ... M SH D D ... D L L ... L
ATMZ
TP1
TP1
TP1
TP1
TP2

Fig 5

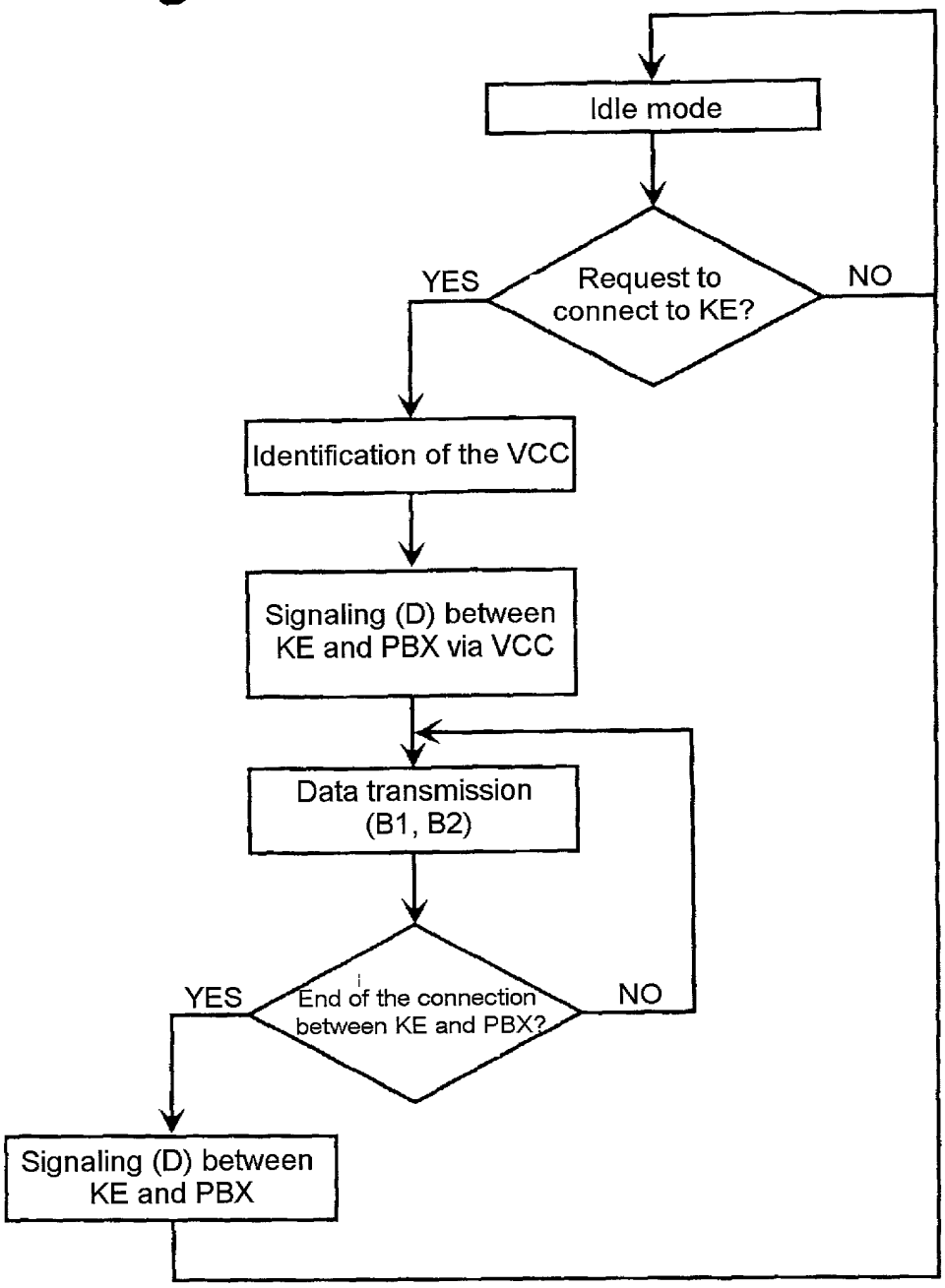
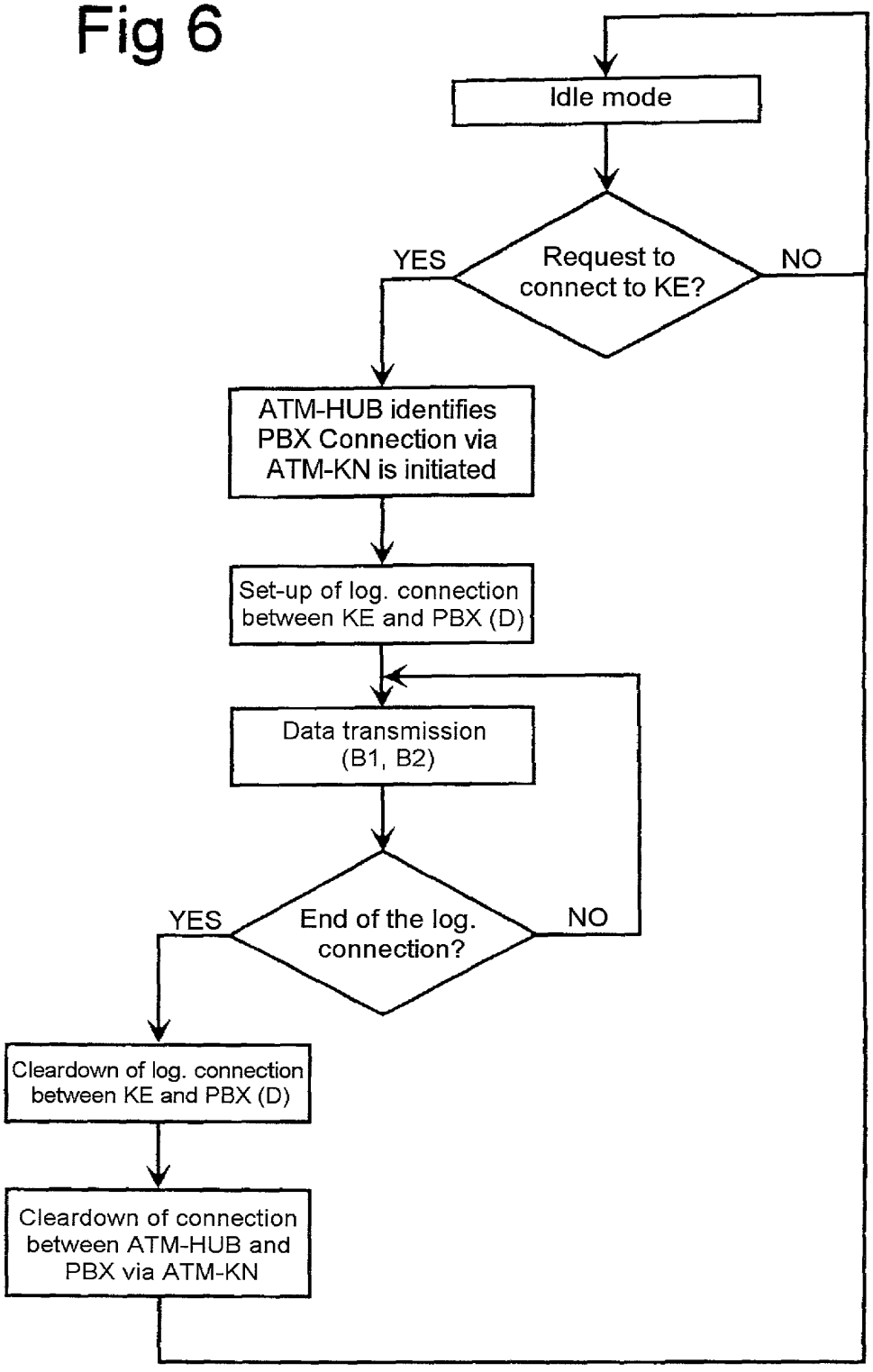

Idle mode
Request to connect to KE?
YES
NO
Identification of the VCC
Signaling (D) between KE and PBX via VCC
Data transmission (B1, B2)
End of the connection between KE and PBX?
YES
NO
Signaling (D) between KE and PBX

Fig 6


Idle mode
Request to connect to KE?
YES
NO
ATM-HUB identifies PBX Connection via ATM-KN is initiated
Set-up of log. connection between KE and PBX (D)
Data transmission (B1, B2)
End of the log. connection?
YES
NO
Cleardown of log. connection between KE and PBX (D)
Cleardown of connection between ATM-HUB and PBX via ATM-KN

Declaration and Power of Attorney For Patent Application
Erklärung Für Patentanmeldungen Mit Vollmacht
German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

As a below named inventor, I hereby declare that:

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

My residence, post office address and citizenship are as stated below next to my name,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Verfahren zur Datenübermittlung ueber ein paket-orientiertes Kommunikationsnetz

Method for data transmission via a packet-oriented communications network

deren Beschreibung

the specification of which

(zutreffendes ankreuzen)
☐ hier beigefügt ist.
☒ am 13.12.1999 als
PCT internationale Anmeldung
PCT Anmeldungsnummer PCT/EP99/09866
eingereicht wurde und am _____
abgeändert wurde (falls tatsächlich abgeändert).

(check one)
☐ is attached hereto.
☒ was filed on 13.12.1999 as
PCT international application
PCT Application No. PCT/EP99/09866
and was amended on _____
(if applicable)

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

German Language Declaration

Prior foreign appplications
Priorität beansprucht

			Priority Claimed	
98123836.3	EP	15.12.1998	☒	☐
(Number)	(Country)	(Day Month Year Filed)	Yes	No
(Nummer)	(Land)	(Tag Monat Jahr eingereicht)	Ja	Nein
			☐	☐
(Number)	(Country)	(Day Month Year Filed)	Yes	No
(Nummer)	(Land)	(Tag Monat Jahr eingereicht)	Ja	Nein
			☐	☐
(Number)	(Country)	(Day Month Year Filed)	Yes	No
(Nummer)	(Land)	(Tag Monat Jahr eingereicht)	Ja	Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35. United States Code. §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occured between the filing date of the prior application and the national or PCT international filing date of this application.

PCT/EP99/09866	13.12.1999		
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date D, M, Y) (Anmeldedatum T, M, J)	(Status) (patentiert, anhängig, aufgegeben)	(Status) (patented, pending, abandoned)
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date D,M,Y) (Anmeldedatum T, M; J)	(Status) (patentiert, anhängig, aufgeben)	(Status) (patented, pending, abandoned)

Ich erkläre hiermit, dass alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und dass ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, dass wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001, Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden koennen, und dass derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

German Language Declaration

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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

(see attached)

And I hereby appoint

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Ext. _____

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Staatsangehörigkeit: DE	Citizenship: DE
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Postanschrift	Post Office Address
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Voller Name des sechsten Miterfinders:	Full name of sixth joint inventor:
Unterschrift des Erfinders Datum	Inventor's signature Date
Wohnsitz ,	Residence ,
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).

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